Policy Innovation Systems for Clean Energy Security

GROWING PAINS: THE DEVELOPMENT AND UTILISATION OF BIOENERGY RESOURCES

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Scope of this Research :

- **Anaerobic digestion/gasification of bioresidues from plantation crops**
- **Options and appropriate scale for power generation from bioenergy resources**
- **Policy formulation in support of bioenergy initiatives**

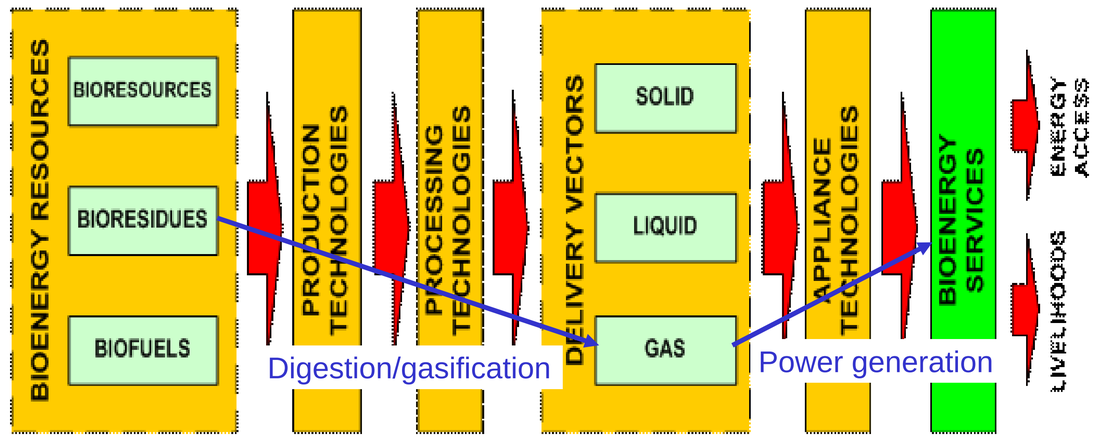


Fig. 1: The bioenergy chain
Improving the efficiency of conversion at each stage in the chain achieves a more effective use of bioenergy resources

Here is one of the greatest, and one of the most neglected, of the present challenges to the chemical engineering community:

"Traditional" bioenergy sources (firewood, charcoal, agricultural residues, cowdung . .) are the principal fuels currently used - and that will continue to be used - by 2.5 billion of the world's population. Worldwide these sources provide *15% of energy consumed*. Debates about biofuels frequently overlook the major significance of these non-marketed bioenergy sources.

Sample result: 96% w/w of sisal crop is waste, normally spread back on land. Anaerobic digestion produces c. 2MJ of gas (CH_4/CO_2) per kg wet waste. In a conventional gas engine this produces c. 0.17 kWh of electricity together with byproduct heat. Digester waste is returned to the land as fertiliser.

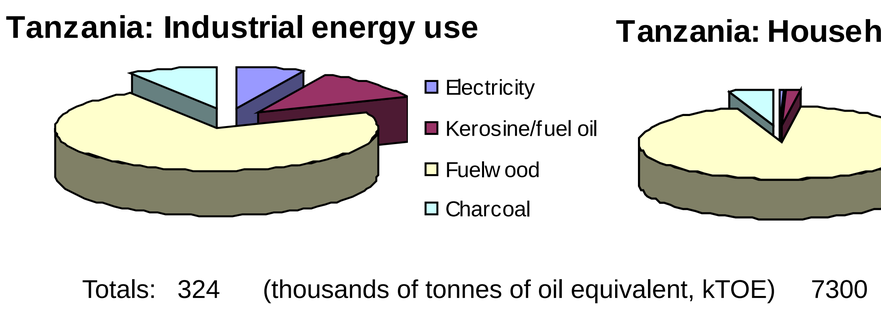


Fig. 2: Energy use in Tanzania, 2006
– wood is the dominant fuel, even in industry

In many of the countries in which biological sources predominate, these are being used unsustainably; and this use combines with deforestation and land degradation to cast severe doubts over the ability of these resources to meet the energy needs of a growing population.

Further, *food* and *fuel* are in competition for increasingly scarce resources of water and cropland; and this is exacerbated by the voracious appetite for biofuels induced in the US and EU. This is in spite of the limited potential of biofuel substitution to reduce carbon emissions and fossil fuel use, when compared with energy efficiency measures.

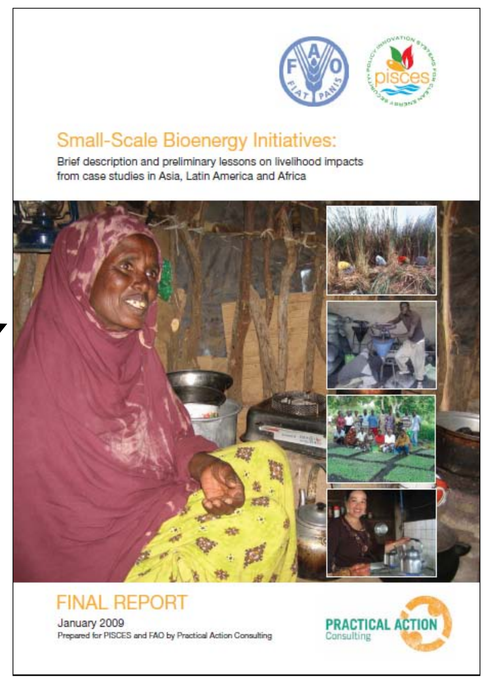
Increasing rural communities' access to modern energy services entails the provision of affordable clean liquid and gaseous fuels for heating, lighting, mechanical power and electricity. Thus there is an urgent imperative to ensure that bioenergy sources are utilised *efficiently and effectively*.

So what will chemical engineers do about it?

Sample result: An ethanol micro-distillery, designed to make cooking grade ethanol (as a substitute for firewood) available at an affordable price in rural communities. Steam raised from bagasse firing is used to strip fermentation ethanol directly. Stillage is used as animal feed.

***2.5 billion* of the world's poorest people rely on bioenergy as their sole source of domestic energy.**

***Chemical Engineers can play a key role:* their skills are needed to develop sustainable resource use and to promote energy access and sustainable livelihoods.**



"Small-scale Bioenergy Initiatives" is a beginning . . .

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